**HERITAGE IIPAM**

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# Movement and Spatial Inter-action of Stocked Rainbow Trout with Native Fishes in the Verde River


Submitted by

Thomas A. Liles
Regional Fisheries Program Manager
Arizona Game and Fish Department
Region III


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## Background

The Verde River flows 145 miles from its headwaters at Sullivan Lake near Pauldin Arizona to Horseshoe Lake (Fig. 1). The flow is in an easterly direction the first 36 miles to the Sycamore Creek confluence, located at River Mile (RM) 109.2[1]. It then flows in a southerly direction past the towns of Clarkdale, Cottonwood and Camp Verde 109 miles before reaching Horseshoe Dam, which forms 2700 surface acre Horseshoe Lake. The Verde River above Sycamore Creek is considered good native fish habitat and is the only portion that still harbors populations of the Federally listed spikedace (Meda fulgida). The Arizona Game and Fish Department (AGFD) has been re-introducing the Federally listed endangered Colorado Squawfish (Ptychocheilus lucius) and razorback sucker (Xyrauchen texanus) since 1985 and 1981, respectively. Early efforts were restricted to the stocking of fry and fingerling squawfish and suckers. These proved unsuccessful. More recently, efforts have been geared towards the stocking of fish 300mm or greater in length. The reason for this was an attempt to preclude predation of the introduced natives by the numerous, well established non-native fish species (e.g. flathead catfish [Pylodictus olivarus], channel catfish [Ictalurus punctatus], smallmouth bass [Micropterus dolomieui] and largemouth bass [Micropterus salmoides]). These efforts continue today, although neither species has been recaptured more than 19 months following release.

The Arizona Game and Fish Department began a winter trout stocking program in the Verde River in 1989. There was an interest for such a fishery in the area, and they determined water temperatures were suitable for rainbow trout (Oncorhynchus mykiss) from November through March in "normal" years. The two areas stocked were better than 10 river miles below the Sycamore Creek confluence area, and 1 river mile below a diversion structure between Tapco and Clarkdale. Due to the angler interest in this program, and the availability of additional rainbow trout following AGFD hatchery renovation, stocking was proposed for 3 additional downstream areas beginning in the winter of 1993-94.

Concern was expressed that the stocked rainbow trout might move from the areas where stocked and negatively impact the listed native fishes through predation and/or competition. This project was designed in an attempt to determine: 1) What are the movement

[1] River Miles are miles upstream of Horseshoe Lake

patterns of rainbow trout stocked into the Verde River; 2) Where do they move to and how long do they stay; and 3) What time of year (March, April, May) do stocked rainbows in the Verde die due to water temperatures. The primary concern was for the movement of the stocked rainbow trout above Tapco (RM 101.8), approaching the Sycamore Creek confluence area (RM 109.2) occupied by the Threatened spikedace.

## Methods

Rainbow trout were to be stocked at five locations (Site 1 - Tuzigoot bridge crossing [RM 97], Site 2 - Deadhorse Ranch State Park low water crossing [RM 96], Site 3 - vicinity of Cottonwood Riverside Park [RM 95], Site 4 - Bignotti [RM 86], and Site 5 - "White Bridge" [General Crook Trail road crossing in Camp Verde, RM 69]). Each site was to be stocked with up to 1000 rainbow trout, every other week during the months of November through March, for a total of 50,000 fish (10,000 per stocking site). All rainbow trout stocked were to bear a distinctive mark identifiable to stocking location (i.e. Site 1 an upper caudal fin punch, Site 2 a lower caudal fin punch, Site 3 both an upper and lower caudal fin punch, Site 4 an adipose fin clip, and Site 5 an anal fin clip). Rainbow trout were anesthetized with MS-222 during the marking procedure. This chemical requires the fish be held 21 days following exposure, before they may be stocked.

Three survey locations on the Verde River were chosen to monitor the movement of the stocked rainbow trout (i.e. just above the Sycamore Creek confluence area, above the Tuzigoot bridge stocking site, and the Beaver Creek confluence area just downstream of "Black Bridge" [Forest Service road 646 crossing] in Camp Verde). Surveys were scheduled monthly from September through August utilizing seines and/or backpack electrofishing equipment. Effort, expressed as square meters of area seined and/or seconds of active electrode backpack electrofishing time were recorded by habitat type. Habitat was defined as pool type or riffle/run type. A 400 meter stretch of river, encompassing both habitat types, was selected at each site. Fish collected were identified to species, and classed as adults, juveniles, or young-of-year. Flow data was obtained from the United States Geological Survey (USGS) Flagstaff, Arizona office. Data from the Clarkdale, Arizona gaging station was incorporated for the Sycamore Creek and Tuzigoot survey sites. Data from the Camp Verde gaging station was incorporated for the Beaver Creek survey site.

**Results**

A total of 27,685 rainbow trout were marked and stocked as follows:

Site 1 - 6236 fish, upper caudal fin punch
Site 2 - 5736 fish, lower caudal fin punch
Site 3 - 4969 fish, upper and lower caudal fin punch
Site 4 - 5341 fish, adipose fin clip
Site 5 - 5403 fish, anal fin clip

Stocking began November 24, 1993 and ended February 24, 1994 (Table I). Each site was stocked once during November and December, and twice during January and February. The reduced stocking in November and December was due to manpower shortage for the labor intensive trout marking activity, coupled with the minimum 21 day required holding period following the use of the anesthetic MS-222. The March stockings were cancelled due to high flows and subsequent warming water temperatures.

Fishery surveys were not initiated at the 3 sites until January 4, 1994 due to: 1) Delays in hiring a seasonal project assistant; 2) Manpower scheduling difficulties; 3) Cancellations due to adverse weather/river flows; and 4) Non-availability of survey equipment. Surveys were conducted monthly through January 1995, with the exception of the months of February and June. Those 2 months were cancelled for the above named reasons. Both seining and backpack electrofishing were originally attempted. Seining the available habitat types proved inefficient to impossible and was deleted as a collecting technique. Both pool and riffle/run habitat types were not available at all sites during some months, due to a variation in river flows.

At the survey site above Sycamore Creek, 1331 fish were collected during 20949 seconds of backpack electrofishing effort (Table II). Flows varied from a low of 79 cubic feet per second (cfs) on July 18 and August 25, 1994 to a high of 200 cfs January 24, 1995. An almost identical number of fish were collected from both habitat types (665 and 666 fish from riffle/run and pool habitats, respectively). Native species accounted for 93.8% of the fish collected (Table III). Sonora sucker (Catostomus insignis) were most common, followed by desert sucker (Pantosteus clarki), roundtail chub (Gila robusta), speckled dace (Rhinichthys osculus), spikedace and longfin dace (Agosia chrysogaster). Non-native species, in descending order of occurrence were: yellow bullhead (Ameiurus natalis), red shiner (Cyprenella lutrensis), smallmouth bass, common carp (Cyprinus carpio) and green sunfish (Lepomis cyanellus). No rainbow trout were observed or collected.

At the survey site above Tuzigoot bridge crossing, 899 fish were collected during 17517 seconds of backpack electrofishing effort (Table IV). Flows varied from a low of 79 cfs on July 18 and

August 25, 1994 to a high of 200 cfs January 24, 1995. More fish (603) were collected from riffle/run habitat than pool habitat (296 fish). Native species accounted for 68.1% of the fish collected (Table V). Desert sucker were most common, followed by sonora sucker, longfin dace and roundtail chub. Non-native species, in descending order of occurrence were: red shiner, green sunfish, common carp, yellow bullhead, smallmouth bass, channel catfish and flathead catfish. No rainbow trout were observed or collected.

At the survey site in the vicinity of the Beaver Creek confluence in Camp Verde, 782 fish were collected during 13426 seconds of backpack electrofishing effort (Table VI). Flows varied from a low of 61 cfs on July 18, 1994 to a high of 394 cfs March 1, 1994. More fish (500) were collected from riffle/run habitat than pool habitat (282 fish). Native species accounted for 37.7% of the fish collected (Table VII). Sonora sucker were most common, followed by desert sucker and roundtail chub. Non-native species, in descending order of occurrence were: red shiner, common carp, green sunfish, smallmouth bass, largemouth bass, flathead catfish, channel catfish, yellow bullhead and bluegill (Lepomis macrochirus). No rainbow trout were observed or collected.

Species distribution varied considerably by site, with natives more common at Sycamore Creek, the uppermost site, and non-natives more common at Beaver Creek, the lower most site, or Tuzigoot (Table VIII). The native speckled dace and spikedace were only collected at the Sycamore Creek site. The non-native largemouth bass and bluegill were collected only at the Beaver Creek site. The native longfin dace was collected only from the upper two sites. The non-native channel catfish and flathead catfish were collected only from the lower two sites. The one exception to the general trend in species distribution was the non-native yellow bullhead which was most common at Sycamore Creek, and least common at Beaver Creek.

Species distribution by habitat type showed 9 of the 15 species collected to be more prevalent in riffle-run habitat (Table IX). Of the 6 native species collected, only the sonora sucker showed no preference for riffle-run habitat (52% were collected from pool habitat; 48% riffle-run habitat). Four of the 9 non-native species were more commonly collected from riffle-run habitat (i.e. smallmouth bass, largemouth bass, flathead catfish and yellow bullhead). The non-native channel catfish, green sunfish, bluegill and carp were more common in pool habitat. The non-native red shiner showed little habitat preference as 49% were collected in pool habitat and 51% in riffle-run habitat.

Seasonal distribution, based on species and number collected, varied considerably (Table X). The native sonora sucker, desert sucker and roundtail chub were collected during each of the

eleven sampling trips, January 1994 to January 1995. Sonora suckers and roundtail chubs were more prevalent January through May, with this heavily influenced by the larger number of juveniles collected. Desert suckers also appeared more common in the January through May period, due to numbers of juveniles. A second peak in number of desert suckers occurred in October, this being influenced by a predominance of adult fish. The native speckled dace and spikedace were only collected during the winter and spring months of January through May. No juveniles or young-of-year (YOY) were collected for either of these species. Forty-eight of the 49 native longfin dace were collected in the spring (March through May). Juveniles dominated the catch in March and adults dominated in April.

The non-native red shiner was sampled January through November, with the most being taken during the late summer to early fall period of August through October. Yellow bullhead were collected each of the eleven months sampled, except November. Smallmouth bass was the only non-native species collected each of the eleven sampling trips. They were more abundant during the spring and summer period of April through August. Largemouth bass and bluegill were only collected during the summer.

Additional survey information collected on the Verde River during this project period included: 1) Random creel census collected by Regional Wildlife Manager incidental to law enforcement activities; 2) Regional fisheries survey of the upper Verde River from the Verde Ranch (RM 135.8) to Perkinsville (RM 121.6); 3) Nongame Branch electrofishing surveys from Tuzigoot bridge (RM 97) to Cottonwood Riverside Park (RM 94) March 2, 1994 and from below Tapco (RM 101) to Tuzigoot bridge (RM 97) September 28, 1994.

Twenty-one random days of creel census were conducted between November 30, 1993 and April 2, 1994. Four of the 5 trout stocking sites were censused (i.e. Tuzigoot Bridge, adjacent to Dead Horse Ranch State Park, Bignotti and "White Bridge" in Camp Verde). One hundred seventeen anglers who had fished 206 hours and caught and kept 174 trout were checked. None of the 5 anglers checked below "Black Bridge" in Camp Verde (the lowermost fishery survey site for the project) caught a trout. A mark was distinguishable on 129 (74.1%) of the trout. Twenty (34.5%) of the trout checked at Tuzigoot showed the upper caudal fin punch used for fish stocked at that site. No mark was observed on the other 38 trout checked from this area. One (25%) of the trout checked adjacent to Dead Horse showed the lower caudal fin punch used on all trout stocked in that area. No mark was observed on the other 3 fish. All 51 (100%) of the trout checked at Bignotti showed the adipose fin clip used for fish stocked at that location. Fifty-seven (93.4%) of the trout checked at "White Bridge" showed the anal fin clip used for fish stocked there. No mark was observed on the other 4 trout.

From May 31 to June 2, 1994, Regional backpack electrofishing and hoop net surveys, via canoe, were conducted on the upper Verde River from the Verde Ranch to Perkinsville. One thousand two hundred twelve fish were collected in 9729 seconds electrofishing and 2 hoop net nights of effort. Native species accounted for 71.8% of the fish collected and included: 537 desert suckers, 254 sonora suckers, 66 roundtail chubs, 19 longfin dace, 3 spikedace and 2 speckled dace. Seven non-native species were collected: 170 red shiners, 113 yellow bullheads, 33 smallmouth bass, 17 green sunfish, 10 carp, 2 flathead catfish and 1 channel catfish. No trout were collected or observed.

On March 2, 1994, Nongame Branch surveyed the Verde River through the upper 3 trout stocking sites with a canoe mounted electrofishing unit. Of note is that these 3 sites were stocked with a total of 3574 trout 7 days prior to this survey. During 3426 seconds of electrofishing effort, 97 fish were collected. These included: 28 sonora sucker, 27 carp, 10 desert sucker, 1 smallmouth bass, 1 channel catfish and 30 rainbow trout. All 30 trout were marked by a caudal fin punch. Additionally, ten fishermen were encountered at Tuzigoot Bridge who had 9 rainbow trout in possession. All 9 angler caught trout showed the upper caudal fin punch used for fish stocked at that site. Sixteen trout were electrofished at the Tuzigoot Bridge site. Fifteen showed the upper caudal fin punch used for fish stocked in that area. One showed a lower caudal fin punch used for fish stocked 3 miles downstream at Dead Horse. One upper caudal fin punched trout was electrofished 1 mile below the Tuzigoot stocking site. One upper and lower caudal fin punched trout was electrofished 1 and 1/2 miles upstream of the Cottonwood Park stocking site. Two upper and lower caudal fin punched trout were electrofished 200 to 300 meters above the Cottonwood Park stocking site. Ten lower caudal fin punched trout were electrofished in the vicinity of the Dead Horse stocking site.

On September 28, 1994, Nongame Branch surveyed the Verde River from below Tapco to the Tuzigoot Bridge. During 1147 seconds of electrofishing effort, 314 fish were collected. Native species accounted for 91.1% and included 155 desert suckers, 87 sonora suckers and 44 roundtail chubs. The following six non-native species were collected: 14 carp, 6 smallmouth bass, 3 green sunfish, 2 yellow bullhead, 2 red shiner and 1 channel catfish. No trout were collected or observed.

## Discussion

From data available, there appears to be little upstream movement of the stocked rainbow trout, and none were collected above the uppermost stocking site at the Tuzigoot Bridge crossing. Trout were only sampled by electrofishing through recently stocked areas. Three of the 30 trout appeared to have moved from the

area where stocked. One was collected 3 miles upstream of where, according to the mark, it was stocked. This fish, which exhibited a lower caudal fin punch and was collected in the area where fish were to be marked with an upper caudal fin punch, may have, however, been mismarked at the hatchery or mixed with the wrong lot of fish at the hatchery. The second trout exhibiting movement had moved downstream 1 mile from its stocking site. The third marked fish had moved 1-1/2 miles upstream from the area where stocked.

The high incidence of "unmarked" fish checked at the upper stocking sites during random creel census may be due to fin regeneration/healing from the fin punch mark used, and subsequent difficulty in detection. Trout were held a minimum of 3 weeks from the time of marking until stocked, and a holding period of 2 months was not uncommon. The high incidence of mark detection from the lower stocking sites where a fin clip was used supports this.

Other possible sources of unmarked rainbow trout would include immigration of fish stocked in Oak Creek, Beaver Creek, or West Clear Creek. During the study period, those waters received a total of 71,000, 6,000, and 6,000 rainbow trout, respectively. Only approximately 3,000 of the rainbow trout for Oak Creek are stocked downstream of the Page Springs Hatchery. The nearest stocking sites to Tuzigoot Bridge are 17 river miles for Oak Creek, and 38 river miles for Beaver Creek and 43 river miles for West Clear Creek.

No trout were found within 10 miles of the lowermost habitat occupied by the Federally listed Threatened spikedace, and no spikedace were found at or below the uppermost trout stocking site.

Tonto National Forest fishery biologist Jerome A. Stefferud, placed temperature recorders in the upper Verde River at the Paulden and Clarkdale gaging stations for the period November 1989 through March 1991. Temperature graphs provided to the Prescott National Forest for the Clarkdale gaging station, showed diel temperatures fluctuated 5 to 8° C, and exceeded 25° C 85% of the days from June 1 through August 15. The upper incipient lethal temperature for adult rainbow trout has been shown to be 25° C (Raleigh et al. 1984).

## Recommendations

1) Continue with the Verde River winter rainbow trout stocking program at the Tuzigoot Bridge crossing and 4 other sites downstream.

2) Survey the Verde River utilizing a small boat mounted electrofishing unit from 1 mile above the diversion structure below Tapco downstream through the upper stocking sites to the vicinity of the Dead Horse Ranch State Park.

3) Begin electrofishing surveys 1 month prior to stocking and continue monthly until trout have not been collected for 2 consecutive months.

4) Conduct larval fish surveys to determine if the Federally listed native species are spawning at or drifting into the upper trout stocking area.

5) Conduct a formal creel census to determine angler use, rate of harvest, estimated total harvest, angler preference and time of year stocked rainbow trout are no longer available to the angler.

## Literature Cited

Raleigh, R.F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat Suitability Information: rainbow trout. U.S. Fish and Wildlife Service, FWS/OBS-82/10. 60, 64 pp.